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ABSTRACT

Reported are the results of an eight-item questionnaire survey of 31 educators (high school teachers and others) representing a nationwide sample of individuals believed to be currently involved in a unified science program at the high school level (grades 9-12). This survey was designed to determine the relationship of unified science to traditional physics and the effect of unified science on high school enrollments in science. Additional information was sought concerning how long the unified science programs had been offered and the relationship of the number of physical concepts presented in traditional physics compared to unified science. Data from the 21 usable returns are included in this paper. Along with other findings and conclusions, the authors suggest that unified science offers a viable solution to declining enrollments in high school physics and that unified science may have extensive application to current trends in secondary school science, providing science for a greater percentage of high school students. (PEB)

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A Survey of Unified Science and Enrollments

by
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Introduction

High school physics enrollments have been steadily declining since physics was first offered as a separate course in 1890.[1] Causes for the decline have been many and varied. In recent years, interest in other natural and social science courses has grown rapidly often at the expense of physics enrollments. If the new courses were to continue to grow, and if the current trend in high school physics were to continue, physics enrollments would continue to decline and eventually diminish. Many educators and scientists however, recognize that physics is important and that something must be done to halt the decline and to increase interest in physics.

One possible solution to the problem of declining physics enrollments is to place physics and other new and traditional science courses into a Unified Science Program. Unified science, unlike separate science courses, views science as a whole, organized around big ideas that permeate all science, with subject matter selected from a broad range of specialized sciences.[2] As new science courses would be developed, their relationship, as with physics, chemistry, biology and earth science, would be highlighted in reference to a unifying theme or big idea.

In an attempt to determine the relationship of unified science to traditional physics, i.e., physics not purposely integrated with other sciences, and the effect of unified science on high school enrollments, the authors surveyed thirty-one educational sites using a unified science approach.

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Utilizing a questionnaire specifically designed for this study the authors would be able to determine approximately how long various high schools had unified science programs; would be able to determine the relationship of the number of physical concepts presented in traditional physics compared to unified science; and would be able to determine the impact of the implementation of a unified science program on high school science enrollments.

Sample

Having developed the questionnaire, the next task was to arrive at a sample to whom the questionnaire would be sent. The authors selected a nationwide sample of thirty-one high school teachers and other educators believed to be currently involved in a unified science program at the high school level. Selected from a list of unified science programs as published by Showalter in 1973, the nationwide sample concentrated primarily on those unified science programs existing at the high school level, grades 9-12.[3] These teachers and educators were chosen as, in the opinion of the authors, they provided a most representative sample of educators having experience with both non-unified science and unified science programs. As the number of persons believed to be teaching unified science in grades 9-12 was small, the investigators felt compelled to address the questionnaire to the entire thirty-one teacher sample.

Methodology

Each subject in the sample was forwarded the eight-item questionnaire and was requested to answer each question, if applicable,

by checking the block that most appropriately represented the situation that existed in thier school. Subjects were requested to add any additional comments they believed necessary to further clarify their response. Having completed the questionnaire the subject was asked to return the questionnaire to the authors by mail.

Results

Responses were received from thirty of the thirty-one persons (97%) to whom the questionnaire was sent. Of the thirty responses, nine persons chose not to answer the questionnaire for the following reasons: their school did not have a unified science program; their school had a unified science program at the elementary level but not at the secondary level; the school did not start a unified science program as it lost one or more of the teachers promoting the program; the educator was no longer associated with a unified science program at the secondary level; or, as only one school reported, the unified science program was discontinued after one year. Eliminating these nine responses the authors had twenty-one responses that provided a representative survey sample of unified science programs existing across the nation.

Question one was mainly administrative in nature and was designed to determine how long each school had a unified/integrated science program. In question one, as in other questions the authors included the words "unified/integrated" as all schools were not unanimous in calling their program "unified." Of the twenty-one responses to question one, seven schools had their program for 2-3

years, two schools had their program for 4-5 years, and twelve schools had their program for 6 or more years.

The emphasis of question two was on schools that had unified science programs that involved less than four years of study; programs in operation for one, two or three years. Question two requested subjects in this category to indicate if there was any discussion or plans directed at expanding their program; eleven schools indicated their program was less than four years long. Of the eleven schools, three indicated there was no such discussion, with one additional school indicating that their program would be expanded if facilities became available.

Question three concentrated on the attitude of unified science educators toward their unified science program. Subjects were asked to indicate if they were sufficiently pleased with their program to recommend it to other educators. Educationally significant is that all twenty-one respondents indicated "YES" to this question. Perhaps even more noteworthy was the fact that several respondents saw it necessary to add further emphasis to their reply to include such remarks as "very much so" and "strongly in favor."

One of the primary means of contrasting traditional physics to physics involved in a unified science program was to compare the number of physical concepts taught in each program. Responses to question four are tabulated in Table 1. As can be seen, only three unified science programs reportedly involved fewer physical concepts than in traditional physics. More significantly, 11 of the 21 unified science programs entailed at least slightly more physical concepts.

Table 1

Response to question four: Do your students receive as many physical concepts in your unified (integrated) science program as they did in the traditional physics course ?

Response	Number Responding	Physical Concepts: Same Amount	Slightly More	Nearly Twice as Many	More Than Twice as Many
N/A	1				
NO	3				
YES	17	6	8	3	0

Since the problem dealt with high school science enrollments and particularly declining physics enrollments, it was appropriate to determine whether the implementation of unified science could be associated with any changes in overall enrollments in grades 9-12, and specifically the school grade level where physics is traditionally taught in the majority of cases, twelfth grade. Responses to questions five, six and seven are tabulated in tables 2 and 3. It was found that 14 of 21 (67%) of the respondents reported an increase in science enrollments in grades 9-12, while 10 of 21 (48%) indicated an increase in science enrollments in the twelfth grade.

Table 2

Response to questions five and six: Has there been any increase in science enrollments attributable to the inception of your unified science program and what is the percentage change ?

Response	Number Responding	Percentage Increase					
		0–10%	10–20%	20–30%	30–40%	40–50%	50% +
NO	7						
YES	14	3	4	2	0	0	3
(Two not indicated)							

Table 3

Response to question seven: Has there been any increase in the number of students taking science during the year physics was traditionally taught ?

Response	Responding	Percentage Increase				
		0–5%	5–10%	10–20%	20% +	cannot be determined
NONE	4					
NO	7					
YES	10	0	2	1	5	2

While seven respondents indicated "NO" to questions five and six, two of the seven respondents indicated they already had high science enrollments:

> Dr. Thomas Gadsden (P.K.Yonge Laboratory School, Gainesville, Florida) stated, "we already had reached a saturation point in enrollments. 280 enrollments out of 270 students grades 10-12."
>
> Mr. Chesley W. Corkum (Deerfield Academy, Deerfield, Mass.) stated that enrollments ". . . remained static — 80% of the student body."

An additional comment furnished by one respondent was not reflected in the questionnaire, but had a direct effect on enrollments. Mr. Norman Worthington (Monmouth Regional High School, New Shrewsbury, N.J.) stated that "retention after the second year (10th grade) has been greatly improved. This year 100% of the students who took Unified II elected Unified III. Difficult to determine a valid base on which to determine a percentage increase."

Question eight, while not directly geared to enrollments, requested the respondent to indicate whether their pupils studying Unified Science gave any indicateion of change in interest, enthusiasm or attitude toward science. Of the 21 respondents, 20 indicated there was, in fact, a change in their pupils interest, enthusiasm and attitude toward science; one respondent was uncertain.

Conclusions

From the questionnaire the authors feel confident in stating the following conclusions for this sample.

1. A significant percentage of schools with unified science programs less than four years in length are discussing lengthening their unified science program.

2. Educational systems with actual experience with unified science are sufficiently pleased with their program so as to recommend it to other educators.

3. A unified science program, in addition to including other sciences, can have at least as many physical concepts as does a traditional physics program and will more likely (11/17 or 65%) contain slightly more physical concepts.

4. A unified science program apparently, in at least 67% of the cases, directly contributes to increased science enrollments in grades 9-12. Moreover, where enrollment increases were reported, the increases varied anywhere from 10-50% or more, with at least a 10-20% increase being the most common.

5. There is approximately a 50% change that those schools having a unified science program will also have an increase in twelfth grade science enrollments. In those schools that reported an increase in twelfth grade science enrollments, the increase ranged from 5-20% or more, with 20% or more being the most common. This finding is particularly significant as the authors were unable to locate any substantial evidence of increased enrollments in twelfth grade science.

Based on the above responses it can be concluded that unified science does offer a viable solution to declining enrollments in high school physics. As it has been shown that a unified science program may entail at least the same number of physical concepts as in the traditional physics course and that unified science will lead to increased science enrollments, science educators should consider the merits of unified science.

While the sample included essentially self-selected school projects with generally outstanding educational facilities and programs, the respondents were reflective of a nationwide interest in unified science.

The authors are not insisting that unified science is "the solution" to declining physics enrollments, but are suggesting that unified science may have extensive application to current trends in secondary school science. It is likely that unified science will provide science to a greater percentage of high school students.

END NOTES

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3. Ibid. Pages 12-36.